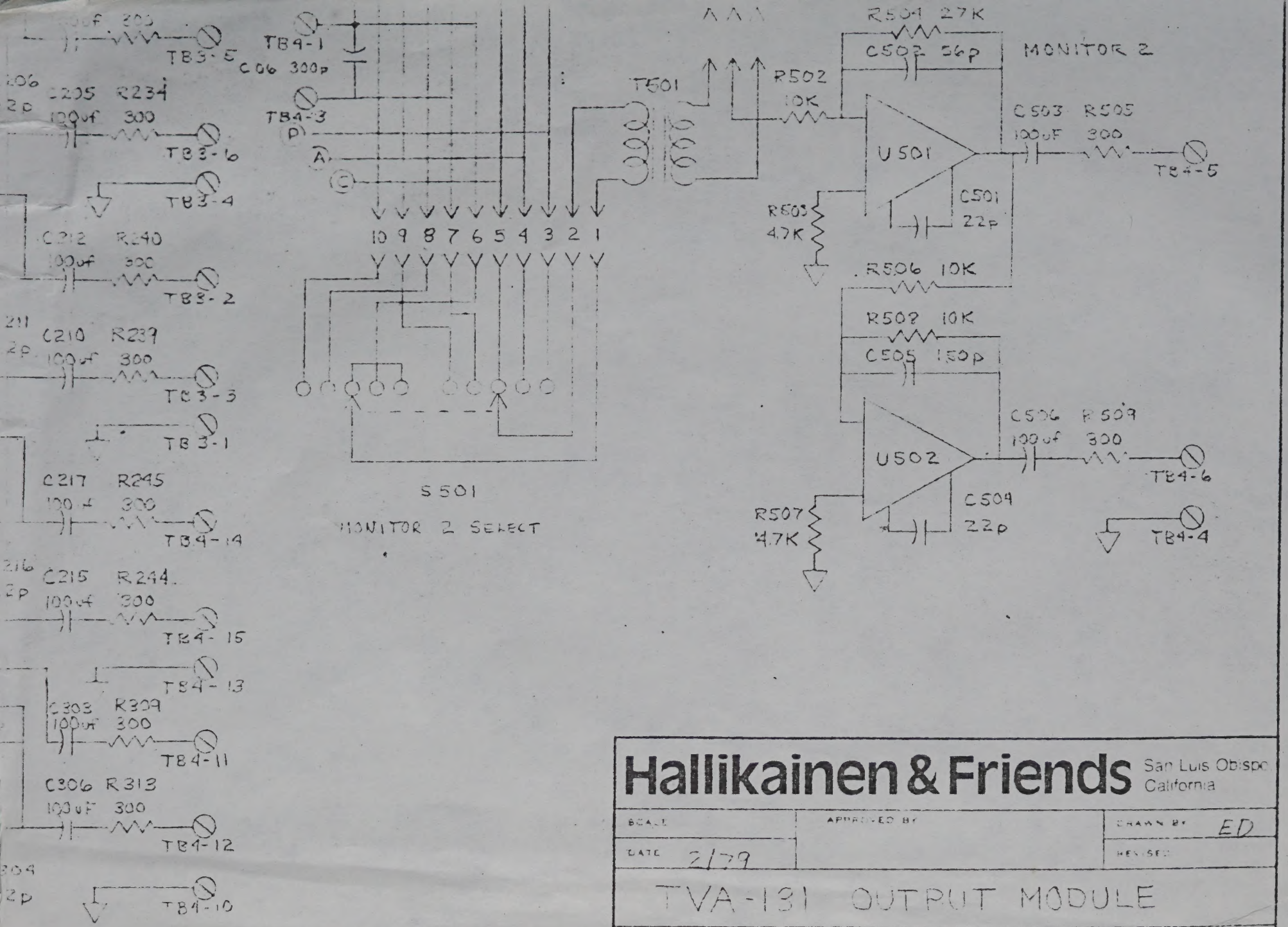

Hallikainen & Friends San Luis Obispo California		
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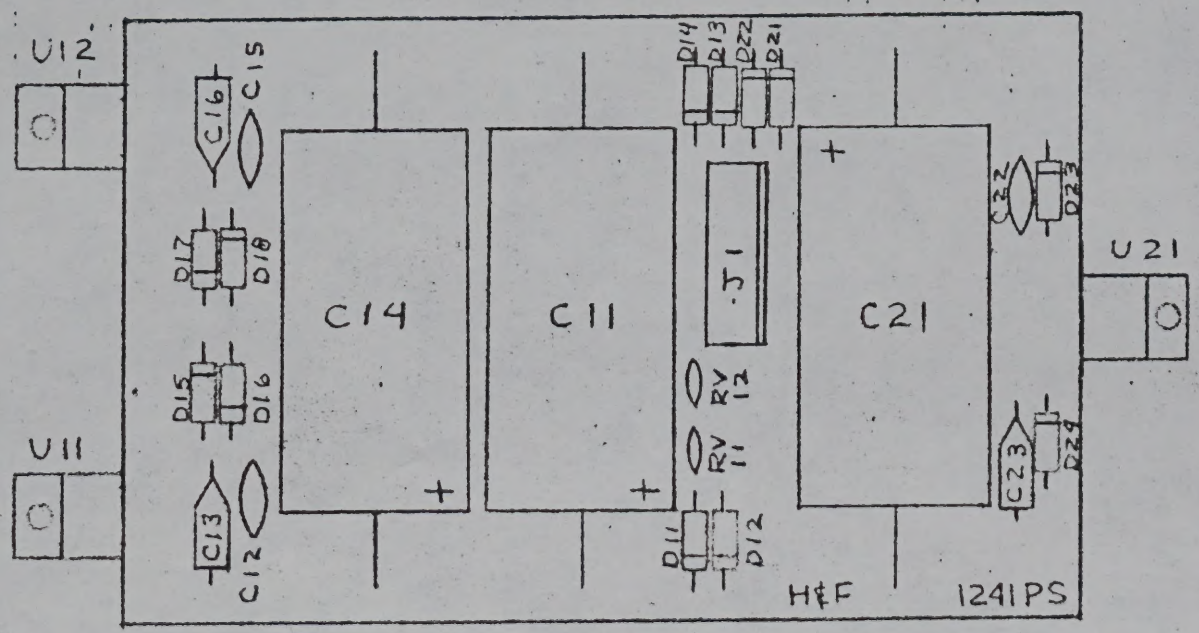
DATE 2/79		REVISED
TVA-131 OUTPUT MODULE		
SCHEMATIC DIAGRAM		DRAWING NO. C-058



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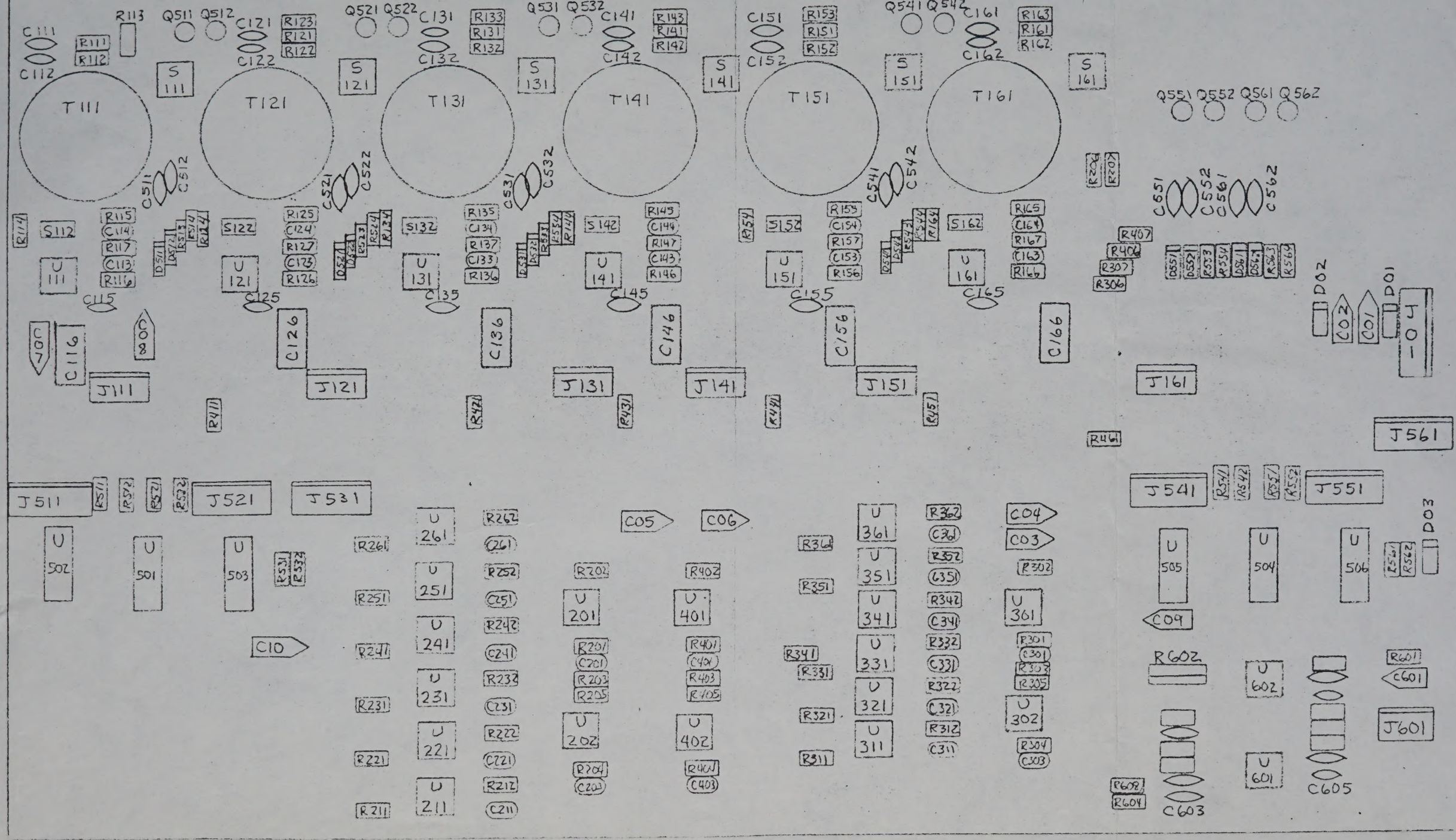
DATE 9/79		REVISED

COMPONENT PLACEMENT - 1241 P.S.

UNIVERSAL POWER SUPPLY

DRAWING NUMBER A-4.2

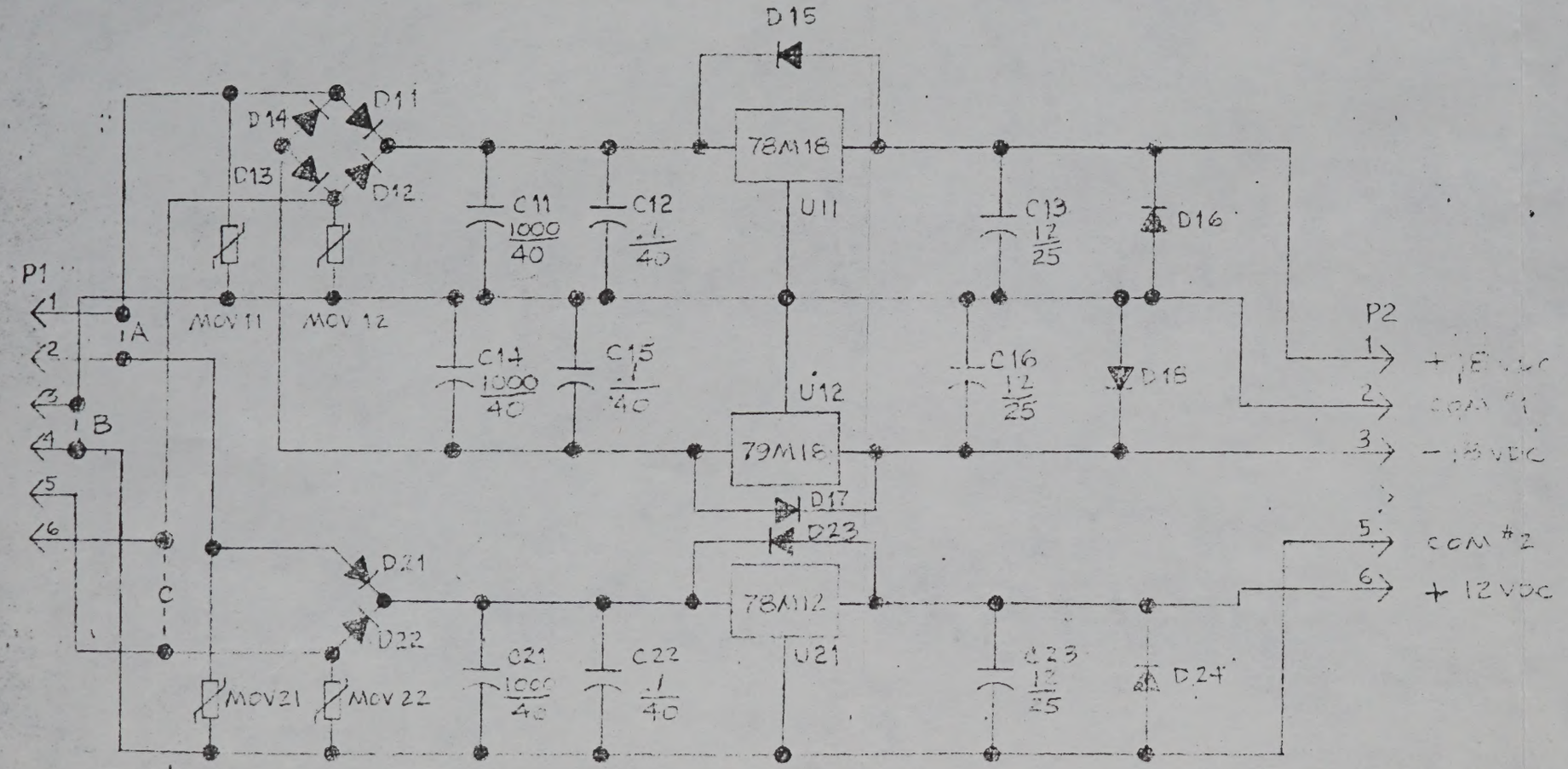
J401
J402
T401
T501
J101
J201
J503
J501
C105
C107
C110
C112
C115
C117
C205
C207
C210
C212
C215
C217
C403
C303
C406
C306
C503
C506
C103
C104
C108
C109
C113
C114
C203
C204
C208
C209
C213
C214
C401
C402
C301
C302
C501
C502
C001
C002
R147
R247
R347
R121
R131
R141
R221
R231
R241
R407
R312
R403
R503
R133
R134
R135
R104
R101
R102
R106
R105
R139
R140
R108
R132
R109
R111
R112
R110
R144
R145
R114
R113
R116
R117
R234
R235
R202
R201
R203
R206
R205
R239
R204
R240
R208
R207
R211
R212
R244
R213
R214
R215
R218
R217
R226
R309
R313
R331
R302
R305
R409
R303
R304
R306
R505
R509
R504
R508
R507
R510
R502
R501
R506
D02
D01
J1
J2
PGM VU
PGM MON
AUD MON
AUD VU
MONITOR


T111
T121
T131
T141
T151
T161
J111
J121
J131
J141
J151
J161
J561
J511
J521
J531
J541
J551
J601
J0-4
U 502
U 501
U 503
U 261
U 251
U 241
U 231
U 221
U 211
U 201
U 401
U 202
U 402
U 361
U 351
U 341
U 331
U 321
U 311
U 302
U 505
U 504
U 506
U 602
U 601
R602
C603
C605
C09
C10
C05
C06
C04
C03
D01
D02
D03

NOTE:

SUPPLY CAN BE LOADED FOR DIFFERENT VOLTAGES AS LISTED BELOW

PRODUCT	VOLTAGES	U11	U12	U21	COMMENTS
LOG121	±12, +5	7812	7912	7805	
TVA 131	±18	7818	7918	——	DELETE ALL 20 SERIES C
TVA 142	±18, +12	7818	7918	7812	



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California

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INSTALLATION

The TVA System is flexible, allowing many types of installation ranging from a simple stand-alone mixer module to a complex thirty-six input AFV fully monitored audio console.

Modules may be installed wherever desired. The only thing to consider is operation. Usually the mixer module will go as close to the operator as possible, with the output module mounted next to it. We recommend the output and mixer modules be separated by no more than ten feet.

TVA 142 Mixer Module: Installation of the TVA 142 Mixer Module consists of selecting the desired input level and connecting the audio inputs, control inputs, mute outputs and audio outputs.

The mixer module inputs are individually selected to either mic or line level by two switches. These switches are internal, mounted on the PC Board. Their adjustment is described based upon their being viewed from the front of the box. Both switches are switched to the left for mic level and to the right for line level operation. Other switch combinations will give non-standard gains and impedances for special situations. Figure 1 shows the location of switches. The switches corresponding to each mixer input are as follows:

Mix 1	select switch	S111 and S112
Mix 2	select switch	S121 and S122
Mix 3	select switch	S131 and S132
Mix 4	select switch	S141 and S142
Mix 5	select switch	S151 and S152
Mix 6	select switch	S161 and S162

The audio inputs connect to TB1 and TB2 on the MIX 1-6 terminals. The input terminates the mic inputs at 150 ohms and line inputs at 10 K-ohms. If the line inputs need further termination, such as 600 ohms, simply add a 620 ohm terminating resistor across the input terminals.

Shielded or unshielded paired wire can be used for line inputs because the transformer inputs are balanced. Shielded wire is recommended for the mic inputs for greatest noise immunity.

The control inputs connect to TB3 and TB4 and are referenced to ground. A ground lug is provided for each input. If an input is to be mixed into the program bus, ground its corresponding CP (control program) terminal. If the input is to be mixed into the audition bus, ground its corresponding CA (control audition) terminal. Both the CA and CP may be grounded simultaneously to feed both channels.

Normally in an audio-follow-video application, each channel's CP would be connected to the ground switched tally output corresponding to the video switcher input that the audio is to follow. Caution: the control inputs must be ground switched. Other devices can be driven from the switched tally only if they are ground switched.

If the switcher tally output is not ground switched, an interface must be built. Most switchers either have existing ground switched outputs or floating relay outputs. One side of these contacts can be tied together and connected to ground to supply ground switching.

The mute outputs for the six channels are also available on TB3 and TB4. They are open collector grounded when activated. They are designed to sink current from relays or other devices to 500 mA with

a voltage no greater than +28 V.D.C. open circuit. Several MA (mute audition) or MP (mute program) outputs can be tied together to combine several mute outputs to one relay. These mute outputs can be used to control a studio monitor relay or for any reason to indicate that an input is on.

The audio outputs for the CUE, AUDITION, and PROGRAM channels are located on TB2. They are balanced 600 ohm impedance outputs. Each output has its own separate ground lug.

An unbalanced load may be driven by one side of the balanced line referenced to ground.

TVA 131 Output Module: Installation of the TVA 131 Output Module consists of connecting the summing amplifier inputs, the external and air monitor inputs, and the line and monitor outputs.

The summing amplifier inputs are unbalanced high impedance. Keep the cables short to avoid ground loops and noise pickup. Use single conductor, shielded cable. Connect the center conductor to one of the TVA 142 PGM out terminals and the shield to associated ground terminal. On the TVA 131, connect the center conductor to one of the P terminals. Connect the shield to the ground lug next to it. In the same manner connect another mixer module from its PGM output to a different P terminal and adjacent ground.

Up to six mixer modules can be connected to one output module. Do not bus the program outputs from one mixer module to another and do not connect more than one mixer output to an input on the output module.

In a similar manner, connect the AUD (audition) output of each mixer module to an A terminal and ground terminal on TB1 and TB2 on the output module using a single conductor shielded cable.

Likewise, connect the CUE output of each mixer module to a Q terminal and ground terminal on TB2 of the output module.

The air and external inputs are provided to bring other inputs up through the monitor amplifiers. Usually, in a broadcast application, the air monitor audio from the demodulator is connected to the AIR input terminals. Both the AIR and EXT inputs are balanced 10 K-ohms impedance.

The output module provides three outputs each for Program and Audition. These are found on TB3 and TB4. Each is 600 ohms balanced and will drive any equal or higher impedance correctly. Unbalanced loads can be driven from one output terminal and ground.

The CUE output is also 600 ohms balanced and is usually connected to a small monitor amplifier and speaker for monitoring the cue bus. Unbalanced loads can be driven from one terminal and ground.

The two monitor outputs also have 600 ohm balanced outputs. These may drive a high quality amplifier and speaker for audio monitoring of any channel in the TVA system. They also can drive unbalanced loads from one output terminal to ground.

THEORY OF OPERATION: TVA 131

The TVA 131 is the output module of the TVA series of audio equipment. The TVA 131 allows for system expansion by mixing the program, audition, and cue outputs of up to six TVA 142 mixer modules.

The TVA 131 also provides audio distribution (three balanced 600 ohm outputs each, for audition and program), program and audition metering, and monitor select and gain control functions.

The TVA 131 is powered by a standard power supply module (H&F part number 0010-0004). The operation of the power supply is explained elsewhere in this manual.

The TVA 131 is based on the NE5534, a high quality operational amplifier. Each op amp is powered with $\pm$ 18 V. A 22 pF high frequency stabilization capacitor is provided for each op amp.

Program and audition circuitry are similar. Only program circuitry will be described here.

Program Operation: Each program input (P1 through P6) is attenuated by an L-pad prior to being applied to the summing amp. For P1 input, this pad consists of R101 and R103. The pad provides 6 dB of loss, and allows for a larger range of gain control in the summing amp.

The output of each pad (high side of R103 for P1) is summed in U101. For P1, the summer gain is determined by R102, R119, and R120. R119 adjusts the overall system gain to unity. C102 provides high frequency roll-off, decreasing system noise. R130 minimizes output offset by balancing bias current voltage drops. The output of U101 is the algebraic sum of inputs P1 through P6.

The output of the summing amplifier drives three balanced line driving amplifiers, each consisting of two unity gain amplifiers. Each line amp operates in a similar manner.

U104 acts as a unity gain inverting amplifier. R136 and R138 set the gain to unity. C109 provides high frequency roll-off. R137 allows the non-inverting input bias current to develop a voltage similar to that on the inverting input, decreasing the output offset voltage.

The output of U104 is coupled through C110 and R139 to the output. C110 blocks any DC offset present on the output of U104. R139 provides half the 600 ohm source impedance that is seen by the load.

U104 also drives M101, the program VU meter. R146 provides for calibration of the VU meter.

U101 also drives U105, a non-inverting voltage follower. This non-inverting amplifier provides the other half of the balanced 600 ohm output.

The balanced audio output appears similar to an output driven by a 600 ohm transformer with the center tap grounded. Unbalanced loads may be driven by connecting the load between one output and ground.

U106, whose operation is identical to U104, also drives R147. R147 provides an adjustable program level to the monitor circuitry.

Cue Operation: The cue outputs of up to six TVA 142s are summed in U301. R307 and the input resistors (R301 through R306) set the gain at unity. C302 provides high frequency roll-off.

U301 drives U302, C302, and R314.

U302 acts as a unity gain inverting amplifier. Gain is set by

R310 and R311. C305 provides high frequency roll-off. R312 allows U302 bias currents to develop balanced voltages, minimizing output offset. C306 blocks any offset voltage, while R313 provides half the line driving impedance.

U301 driving C303 and R309 provides the second half of the balanced cue output.

U301 drives R314 to provide an adjustable level to the monitor select circuitry.

Monitor Operation: The TVA 131 provides two balanced 600 ohm outputs for driving monitor amplifiers.

The monitor circuitry consists of active balanced line drivers (similar to the cue output amplifier) driven by a front panel level control and input transformer. The input transformer allows the external monitor inputs to be balanced bridging.

The monitor select switches connect the input transformer primary to one of the program feeds in the TVA 131, or to one of the external inputs. Level controls are provided on each internal monitor feed to allow levels to be balanced with external sources.

THEORY OF OPERATION: TVA 142

The TVA 142 is a high quality audio mixer designed around the NE5534 operational amplifier. Standard op-amp techniques are used throughout. The following discussion provides specific details on the circuit design to aid in trouble-shooting. Refer to the TVA 142 schematic diagram.

Preamplifier Section: The TVA 142 contains six preamps, one for each input. The preamp section converts the balanced line to unbalanced in an input transformer, provides gain, and provides impedance matching.

The preamp section of input one will be discussed in detail.

T111 provides balanced-to-unbalanced conversion, impedance conversion, and voltage gain. S111 determines whether the input is to bridge a 600 ohm line or operate from a 50 to 250 ohm microphone source. When in the line position, R111, R112 and R113 provide the 18 dB loss necessary to prevent transformer overload while presenting a high (bridging) impedance to the line and a low impedance to the transformer primary. When in the microphone position, S111 connects the input directly to the 150 ohm primary of T111. Due to the low source impedance, the loading through R111 and R112 is neglegible.

When in the microphone position, T111 provides a voltage gain of 10 (20 dB) due to its turns ratio. Since the secondary of T111 is terminated in 47K (R114), an additional voltage gain of 1.5 (3.5 dB) is achieved over a matched termination.

C111, C112 and the electrostatic shielding in T111 provide protection from RF fields.

U111 provides a gain of 7.7 (18 dB) or 34 (31 dB) depending upon the setting of S112. S112 is typically in the low-gain position for a line input and in the high-gain position for a mic input. It may, however, be put in the high-gain position for a low-level line (such as network or remote line). C113 and C114 roll off the high frequencies starting at about 50 KHz in both gain settings. C115 provides high-frequency stability for the op-amp.

U111 drives the front panel gain control assembly (H&F part number 0010-0001) through C116. C116 eliminates any DC offset that may be present on the output of U111.

The front panel gain control is a relatively low resistance pot with a "cue switch". The low resistance (1 K) provides a low driving impedance to the LDRs and summing resistors and provides noise immunity.

When in the cue position, the control assembly drives a summing amplifier (U401) through R411. The wiper of the control assembly provides audio to the output bus assign circuitry.

Output Bus Assignment Circuitry: Output bus assignment is accomplished with optic couplers. When current flows through the couplers LED, the resistance of the LDR (CdS light dependent resistor) drops. The LDRs are driven by logic circuitry sampling external control signals, and are driven by a front panel lever switch (H&F part number 0010-0002). The lever switch operates independently of the logic circuitry so that manual control can be provided should the logic fail. A sample of the control signal driving the LDR drives a transistor for each channel providing an open collector "muting" output. This output can drive monitor muting circuitry, warning lights, or be used to start the selected device (i.e. cart start).

The program bus assignment circuitry of input one will be discussed in detail.

An external contact closure to ground (or open collector transistor pulling to ground) on the CP (Control Program) input of channel one (TB3-1) will cause the output of the channel one preamp section to be assigned to the program bus.

When TB3-1 is pulled low, the input to U501 is pulled low through D511. D511 provides protection from more positive external control voltages, allowing the control signal driving the CP input to control other devices. C511 provides protection from RF. R511 provides a pull-up so that an open input is interpreted as a logic one. U501 is an inverting Schmitt trigger. It provides noise immunity, insuring the LDR is driven all the way on or off. U502 is an open source (similar to bipolar emitter follower) CMOS buffer. When U501 provides a logic 1 input, U502 provides enough current on its output to drive U212 (the LDR) through the Program LED in the switch assembly and R211. The output of U502 can also be driven high (activating the LED and LDR) by setting the front panel switch in the program position. A channel can be assigned by either the front panel lever switch or an external control signal. It is permissable to assign one preamplifier output to both program and audition busses through external control signals and switch settings.

When the LED of U212 is driven by either an external control signal or the front panel switch, Q511 is turned on through R513 which causes the collector to pull to ground. This provides an external status signal indicating that channel one is assigned to program. This output

(MP on TB3-4) can be used to mute studio monitors, or other control purposes. Several Muting outputs can be tied together to cause muting when any of several inputs are assigned to program. Similar provisions are available for the audition channel.

Once the LED of U212 is activated, indicating assignment of channel one to program, the LDR allows audio to pass through R212 to U201, the program bus summing amp. The gain of U201 is set to 8.3 (18 dB) by R201 and the corresponding input resistor (such as R212).

C211 and R202 provide a low level signal to the non-inverting input of U201 to compensate for leakage to the inverting input through the LDR. C201 and R201 provide a high frequency roll-off at about 50 KHz. C202 provides high frequency stability for U201.

Line Driver: The TVA 142 provides three active balanced 600 ohm outputs. These outputs are for the program bus, the audition bus, and the cue bus. The line drivers are the same, except for required differences in gain in the first summing amplifier.

U201 and U202 provide the program output. U201 is the program bus summing amplifier. U202 is a unity gain inverting amplifier, providing the second half of the balanced line. The output appears similar to the output obtained from a transformer with the center tap grounded, except that the source impedance seen by an unbalanced load (one line to ground) here is 300 ohms, and would be 150 ohms with a transformer output.

The output can be used to drive either balanced or unbalanced loads. With unbalanced loads, the load is driven by one line to ground.

When making test measurements with an unbalanced input audio voltmeter, the levels will appear the same as would be applied to a

balanced terminating load, when bridging from one side to ground. There is a 6 dB gain since the meter does not terminate the output (causing no drop across the internal resistor) and a 6 dB loss since only one side of the line is sampled.

Peak Flashers: Peak flashers are provided on the audition and program outputs as a means of determining output level.

The peak flashers are based upon the NE555V timer. The program peak flasher will be discussed in detail.

R602 and R603 provide an adjustable bias signal to the trigger input (pin 2) of U601. Program audio is coupled through R604 and C603 to the trigger input, where it is combined with the bias signal. When a negative program peak causes the trigger input to U601 to go below 4 bolts, the output (pin 3) is driven high, lighting the program peak flasher LED. When the output (pin 3) of U601 goes high, a saturated transistor holding pin 7 at ground potential is turned off, allowing C604 to charge through R606.

After the voltage at the threshold input (pin 6) reaches 8 volts, the timer is reset. This causes pins 3 and 7 to go low, extinguishing the LED and discharging C604 until the next program peak. C605 bypasses the internal reference voltage in U601. The persistence provided by the timer insures that even the shortest program peaks will be displayed.

The bias level set by R602 can be varied to allow the peak flasher to trigger at various levels.

The TVA 142 combines innovative audio and control circuitry to provide a high quality audio mixer.

ADJUSTMENTS

The TVA system is shipped fully checked out and ready for installation. It might be necessary to make some adjustments because your operating requirements are different than the factory settings. Therefore, a complete setup procedure will be discussed.

The following equipment will be necessary for checking out the TVA system:

DC Voltmeter

AC Voltmeter

Low Distortion Audio Generator

Distortion Analyzer

TVA 142: Adjusting the TVA 142 Mixer Module for proper operation consists of checking the power supply voltages and setting the indicating level of the program peak flasher.

Check to see that both the positive and negative 18 volt power supplies are operating within one volt of plus and minus 18 volts. The power supplies can be easily checked at the power supply connector JØ1. Pin 1 is the plus 18 volt and pin 3 is the minus 18 volt connector. Use chassis ground as the meter reference. Also check the plus 12 volt logic supply. It should be within one volt of plus 12 volts.

Connect the audio generator to the MIX 1 terminals. Adjust the output of the generator for -10 dBm and a frequency of 400 Hz. Switch the MIX 1 lever switch to P and the MIX 1 gain control fully clockwise. Check to see that the MIX 1 gain switch S112 is in the line level position and that the MIX 1 transformer select switch is in the line

winding position (both switches to the right). Refer to figure 1 for the location of the switches. Connect the audio voltmeter or distortion analyzer to a PGM output terminal and the ground next to it. The output level should be +8 dBm, or other desired output level between Ø and +8 dBm. Normally the peak flashers are set to indicate a level 10 dBm over the nominal output level, but they may be adjusted to any level between 0 and +23 dBm. Adjust the audio generator output to increase the output level measured at the PGM terminal to +18 dBm. Adjust the peak flasher level. Set pot R602 so that the PROGRAM peak flasher just lights. This also sets the level of the AUDITION peak flahser.

Return the generator output level to -10 dBm. Check that the other PGM terminal to ground also has an output of +8 dBm. Check the audition channel by throwing the MIX 1 lever switch to A.

Connect the voltmeter to one AUD terminal and ground next to it. The voltmeter should read +8 dBm with the input level still at -10 dBm. Check that the other PGM terminal to ground also has an output of +8 dBm. Turn the MIX 1 gain control fully counterclockwise to switch it into the CUE position. Change the voltmeter to a CUE terminal and the ground next to it. Read the output level. It should be -10 dBm. Check the other CUE terminal to ground to insure it also has an output level of -10 dBm.

Check the other MIX inputs with the audio generator set to produce -10 dBm at 400 Hz. Set the gain pots fully clockwise and insure that the inside gain switches and transformer winding select switches are in the line positions. Again, refer to figure 1 for the location of the switches.

Check the inputs one at a time by connecting the generator to the MIX terminals and reading the output on a voltmeter connected first to a PGM terminal and ground and then to an AUD terminal and ground. Turn the gain control counterclockwise into the CUE position and check the output at a CUE terminal and ground. The normal output level for the PGM and AUD channels is +8 dBm. The normal output level for the CUE channel is +8 dBm with a +8 dBm input.

After all the inputs have been checked in the line configuration, check them in the mic configuration by reducing the output of the audio generator to -58 dBm. Change all the gain select switches to mic level and the transformer winding select switches to mic winding. Check that all the MIX channels one by one with the gain control fully clockwise produce a level of +8 dBm at one PGM terminal and ground. This completes the setup and checkout of the TVA 142 Mixer Module.

TVA 131: Adjusting the TVA 131 Output Module for proper operation consists of checking the power supply, voltages, setting the gain of the program and audition amplifiers, calibrating the VU meters, and adjusting the monitor levels to provide equal output no matter which switch position is selected.

Insure that both the positive and negative power supplies are operating within one volt of plus and minus 18 volts. The power supplies can be easily checked at the power supply connector J01. Pin 1 is the plus 18 volt and pin 3 is the minus 18 volt connector. Use chassis ground as a reference.

Connect the audio generator to the P1 terminal and ground. Adjust the output of the audio generator to +8 dBm at a frequency of 400 Hz.

Connect an audio voltmeter or distortion analyzer to a PGM terminal and ground. Adjust the program gain control R119 for a level of +8 dBm measured at the PGM terminal. Refer to figure 2 for location of controls. The gain control will allow other output levels if desired. Set the program VU calibrate control R146 to make the program VU meter read 0 VU. Check the other terminal of the PGM output used. It should read +8 dBm also.

Check the remaining PGM outputs one terminal at a time to a ground to insure that they all read +8 dBm.

Leave the audio voltmeter connected to one PGM output and a ground. Connect the remaining P inputs one at a time to the audio generator to insure they all work.

Repeat the above procedure for the Audition channel. The audition gain control is R219 and the audition VU calibrate control is R246. Connect the audio generator to the Q1 terminal and ground.

Set the output to +8 dBm at 400 Hz. Connect the audio voltmeter or distortion analyzer to a CUE terminal and ground. The voltmeter should read +8 dBm. The CUE channel gain is not adjustable, but is fixed at unity. Insure that the other CUE terminal to ground is also reading +8 dBm. Check the remaining Q inputs one at a time to insure that they work.

Connect the audio generator to the AIR input. This is a transformer input so connect it across both sides. Adjust the oscillator level for 0 dBm. Set the output frequency to 400 Hz. Connect the voltmeter to one side and ground of the MON 1 output. It should be +8 dBm.

Disconnect the audio generator from the AIR input and connect it to the P1 terminal and ground. Reset the output level of the audio

generator to +8 dBm. Select the PGM pushbutton on the Monitor 1 selector. Adjust R147, program monitor level, for +8 dBm, measured at the MON 1 output.

Connect the audio generator to the A1 terminal and ground. Select the AUD pushbutton on the Monitor 1 selector. Adjust R247, audition monitor level, for +8 dBm. Connect the audio generator to the Q1 terminal and ground. Select the CUE pushbutton on the Monitor 1 selector. Adjust R314, cue monitor level, for +8 dBm. Set the audio generator level back to 0 dBm. Connect it to the EXT terminals. Connect across both terminals because this is a transformer input. Select the EXT pushbutton on the Monitor 1 selector. A level of +8 dBm should be measured at the Mon 1 output terminals. Connect the voltmeter to the other MON 1 output terminal and ground. Check for a reading of +8 dBm.

Connect the voltmeter at a MON 2 terminal and ground. Select the EXT pushbutton on the Monitor 2 selector and turn the Monitor 2 gain control fully clockwise. The voltmeter on the MON 2 output should read +8 dBm. Check the other MON 2 terminal to ground for a reading of +8 dBm. Check the AIR selector with the audio generator set to 0 dBm. Check the PGM, AUD, and CUE selectors with the audio generator set to +8 dBm. This completes the alignment of the TVA 131 Output Module.

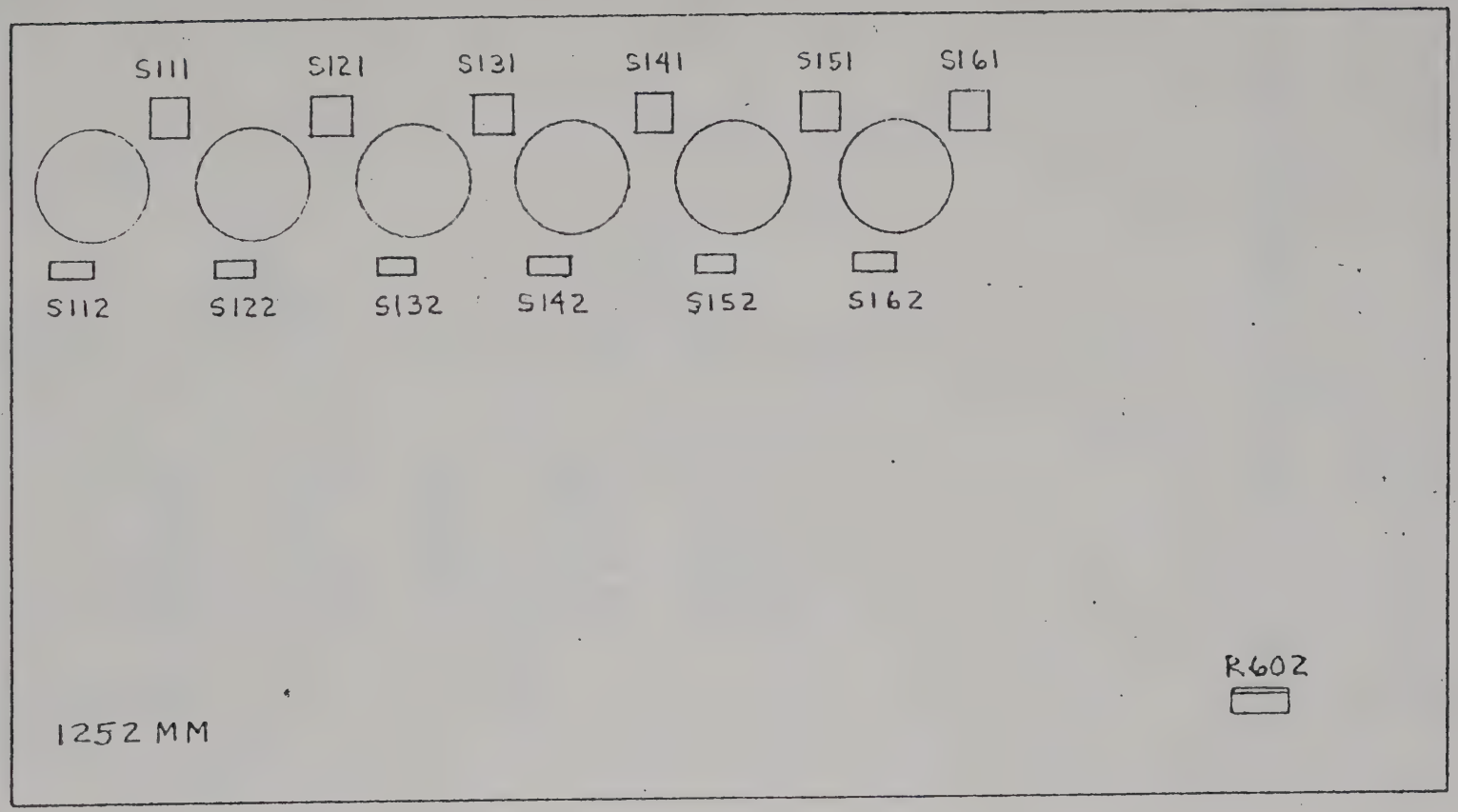

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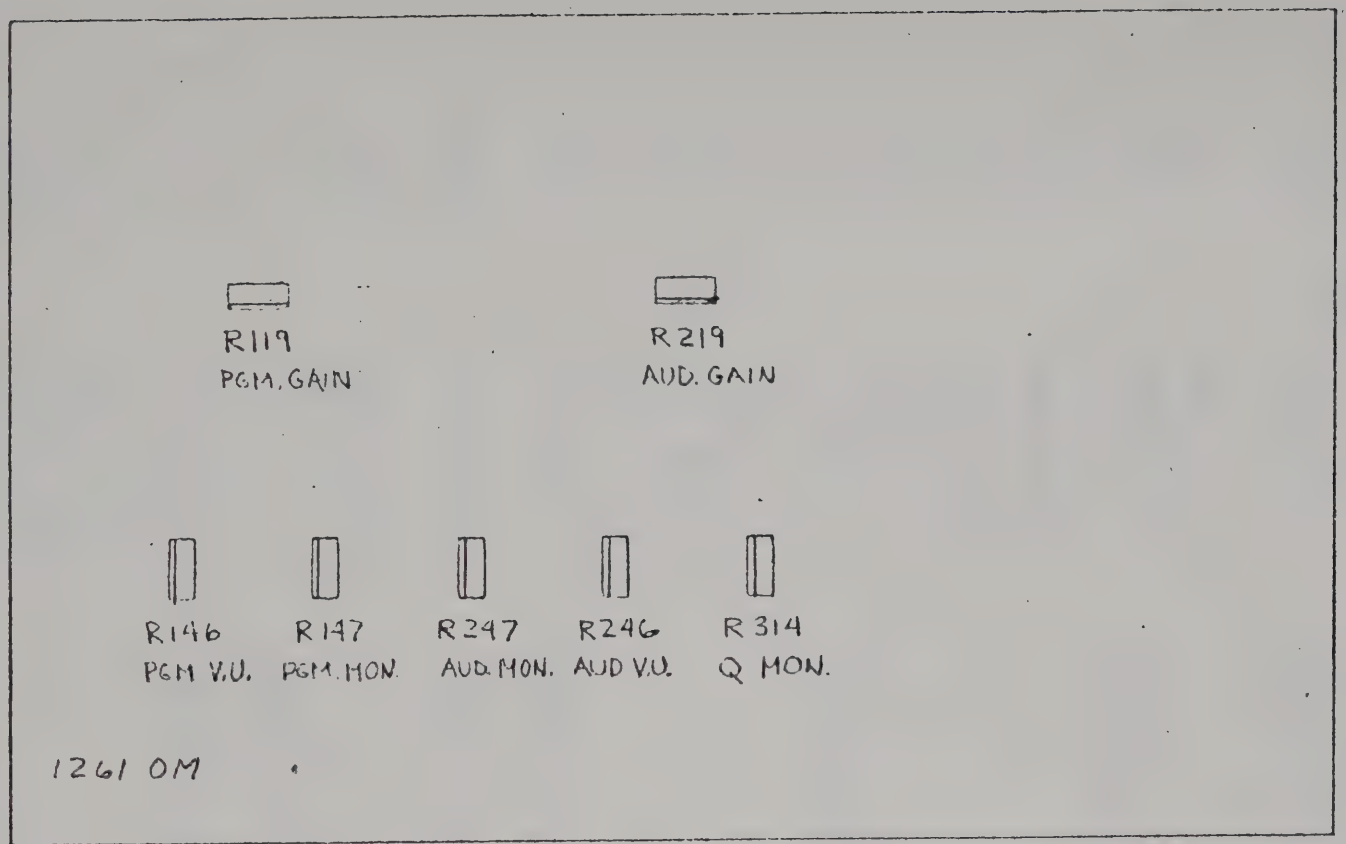
FIGURE 1 - SWITCH LOCATION TVA-142		
		DRAWING NUMBER A-040



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DATE 8/79		REVISED

FIGURE 2 - CONTROL LOCATION TVA - 131

DRAWING NUMBER A-041

TVA 131 PARTS LIST

Component Designation	H&F P/N	Description
C01	1535-1261	Capacitor, Tantalum, Mallory TAC126K025P04, 12 uF, 25V
C02	same as C01	
C03	1508-3010	Capacitor, Ceramic, Mallory GP-330, 300 pF, 1000 V
C04	same as C03	
C05	same as C03	
C06	same as C03	
C07	1508-1041	Capacitor, Ceramic, Mallory MAG 2501, .1 uF, 25V
C08	same as C07	
C09	same as C07	
C10	same as C07	
C101	1508-2200	Capacitor, Ceramic, Mallory GP-422 22pF, 1000 V
C102	1529-5600	Capacitor, Polystyrene, Mallory SX-456, 56 pF, 500 V.
C103	same as C101	
C104	1529-1510	Capacitor, Polystyrene, Mallory SX-315 150 pF, 500 V
C105	1510-1070	Capacitor, Electrolytic, Arco ME-7G-100, 100 uF, 50 V
C106	same as C101	
C107	same as C105	
C108	same as C101	
C109	same as C104	

TVA 131 PARTS LIST (Cont)

Component Designation	H&F P/N	Description
C110	same as C105	
C111	same as C101	
C112	same as C105	
C113	same as C101	
C114	same as C104	
C115	same as C105	
C116	same as C101	
C117	same as C105	
C201	same as C101	
C202	same as C102	
C203	same as C101	
C204	same as C104	
C205	same as C105	
C206	same as C101	
C207	same as C105	
C208	same as C101	
C209	same as C104	
C210	same as C105	
C211	same as C101	
C212	same as C105	
C213	same as C101	
C214	same as C104	

TVA 131 PARTS LIST (cont)

Component Designation	H&F P/N	Description
C215	same as C105	
C216	same as C101	
C217	same as C105	
C301	same as C101	
C302	same as C104	
C303	same as C105	
C304	same as C101	
C305	same as C104	
C306	same as C105	
C401	same as C101	
C402	same as C102	
C403	same as C105	
C404	same as C101	
C405	same as C104	
C406	same as C105	
C501	same as C101	
C502	same as C102	
C503	same as C105	
C504	same as C101	
C505	same as C104	
C506	same as C105	
D01	4800-4002	Diode, Silicon, 1N4002, 1 A 100 PIV

TVA 131 PARTS LIST (cont)

Component Designation	H&F P/N	Description
D02	same as D01	
J01	2100-0106	Connector, 6 pin, Molex 09-60-1061
J101	2100-0104	connector, 4 pin, Molex 09-60-1041
J102	same as J101	
J401	2100-0110	Connector, 10 pin, Molex 09-60-1101
J402	2100-0103	Connector, 3 pin, Molex 09-60-1031
J501	same as J401	
J502	same as J402	
M01	2900-0001	VU Meter, Dixson 330 994E, W/1amps
M02	same as M01	
R101	4711-4103	Resistor, Carbon, ¼ watt, 5%, 10K
R102	4711-4473	Resistor, Carbon, ¼ watt, 5%, 4.7K
R103	same as R102	
R104	same as R101	
R105	same as R102	
R106	same as R102	
R107	same as R101	
R108	same as R102	
R109	same as R102	
R110	same as R101	
R111	same as R102	
R112	same as R102	

TVA 131 PARTS LIST (cont)

Component Designation	H&F P/N	Description
R113	same as R101	
R114	same as R102	
R115	same as R102	
R116	same as R101	
R117	same as R102	
R118	same as R102	
R119	4766-2503	Trim Pot, CTS X201R503B, 50K
R120	4711-4822	Resistor, Carbon, ¼ watt, 5%, 8.2K
R121	same as R102	
R131	same as R101	
R132	same as R101	
R133	same as R101	
R134	4711-4301	Resistor, Carbon, ¼ watt, 5%, 300 ohm
R135	same as R134	
R136	same as R101	
R137	same as R102	
R138	same as R101	
R139	same as R134	
R140	same as R134	
R141	same as R101	
R142	same as R102	
R143	same as R101	

TVA 131 PARTS LIST (cont)

Component Designation	H&F P/N	Description
R144	same as R134	
R145	same as R134	
R146	4766-2103	Trim Pot, CTS X201R103B, 10K
R147	same as R146	
R201	same as R101	
R202	same as R102	
R203	same as R102	
R204	same as R101	
R205	same as R102	
R206	same as R102	
R207	same as R101	
R208	same as R102	
R209	same as R102	
R210	same as R101	
R211	same as R102	
R212	same as R102	
R213	same as R101	
R214	same as R102	
R215	same as R102	
R216	same as R101	
R217	same as R102	
R218	same as R102	

TVA 131 PARTS LIST (cont)

Component Designation	H&F P/N	Description
R219	same as R119	
R220	same as R120	
R231	same as R101	
R232	same as R102	
R233	same as R101	
R234	same as R134	
R235	same as R134	
R236	same as R101	
R237	same as R102	
R238	same as R101	
R239	same as R134	
R240	same as R134	
R241	same as R101	
R242	same as R102	
R243	same as R101	
R244	same as R134	
R245	same as R134	
R246	same as R146	
R247	same as R146	
R301	same as R101	
R302	same as R101	
R303	same as R101	

TVA 131 PARTS LIST (cont)

Component Designation	H&F P/N	Description
R304	same as R101	
R305	same as R101	
R306	same as R101	
R307	same as R101	
R308	same as R102	
R309	same as R134	
R310	same as R101	
R311	same as R101	
R312	same as R102	
R313	same as R134	
R314	same as R146	
R401	0010-0007	Pot Assembly, 10K
R402	same as R101	
R403	same as R102	
R404	4711-4273	Resistor, Carbon, ¼ watt, 5%, 27K
R405	same as R134	
R406	same as R101	
R407	same as R102	
R408	same as R101	
R409	same as R134	
R501	same as R401	
R502	same as R101	

TVA 131 PARTS LIST (cont)

Component Designation	H&F P/N	Description
R503	same as R102	
R504	same as R404	
R505	same as R134	
R506	same as R101	
R507	same as R102	
R508	same as R101	
R509	same as R134	
S401	0010-0006	Selector Switch Assembly
S501	same as S401	
T401	5605-0001	Transformer, UTC PC-0-26, 10K:10K
T501	same as T401	
TB1	2100-0035	Terminal Strip, Magnum, 2061-15-06-AB
TB2	same as TB1	
TB3	2100-0036	Terminal Strip, Magnum, 2051-15-06-AB
TB4	same as TB3	
U101	3130-5534	Operational Amplifier, NE5534
U102	same as U101	
U103	same as U101	
U104	same as U101	
U105	same as U101	
U106	same as U101	
U107	same as U101	

TVA 131 PARTS LIST (cont)

Component Designation	H&F P/N	Description
U201	same as U101	
U202	same as U101	
U203	same as U101	
U204	same as U101	
U205	same as U101	
U206	same as U101	
U207	same as U101	
U301	same as U101	
U302	same as U101	
U401	same as U101	
U402	same as U101	
U501	same as U101	
U502	same as U101	

TVA 131 PARTS LIST
(non designated parts)

H&F P/N	Description
1400-0506	Chassis back
1400-0507	Rack Panel
1400-0508	Chassis front
1400-0509	Chassis box
2100-0005	IC Socket, 8 pin
2100-0019	Buss HKP, Single D fuse holder
2410-0002	Rogan RB6725K7M ¼ Blk knob
2803-0006	Mallory TCBS6N 3/8" spacer
2807-8349	HH. Smith 8349 1-½" spacer
3130-7818	Regulator, 7818/LM340T-18, +18 V
3130-7918	Regulator, 7918/LM 320T-18, -18 V
4104-0005	Buss AGC ½, ½ Amp Fuse
5633-8613	Stancor P8613 36 V Transformer
6028-7239	Belden 17239B Line cord
6036-0939	H.H. Smith #939 Strain relief

0010-0006 SWITCH ASSEMBLY

H&F P/N	Description
1400-0501	Switch bracket
1706-1271	H&F 1271 SW P.C. Board
2100-0130	Connector, Molex 09-50-7101, 10-pin
2100-0158	Pin, Molex 08-50-0108
5157-0005	Switch, Schadow 5XF, 17.5 FE/BLK/24/GR 5 station DPDT

0010-0007 POT ASSEMBLY

H&F P/N	Description
2100-0123	Connector, Molex 09-50-7031, 3 pin
2100-0156	Pin, Molex 08-50-0108
4757-0103	Pot, Bournes 82A1A-B28-D15, 10K

TVA 142 PARTS LIST

Component Designation	H&F P/N	Description
C01	1535-1261	Capacitor, Tantalum, Mallory TAC126K025PU4, 12 uF, 25 V
C02	same as C01	
C03	same as C01	
C04	same as C01	
C05	same as C01	
C06	same as C01	
C07	same as C01	
C08	same as C01	
C09	same as C01	
C10	same as C01	
C111	1508-3010	Capacitor, Ceramic, Mallory GP-330, 300pF, 1 KV
C112	same as C111	
C113	1529-2000	Capacitor, Polystyrene, Mallory SX-420, 20pF, 500 V
C114	1529-5600	Capacitor, Polystyrene, Mallor SX-456, 56 pF, 600 V
C115	same as C113	
C116	1510-5060	Capacitor, Electrolytic, Arco ME4G050, 50 uF, 25 V
C121	same as C111	
C122	same as C111	
C123	same as C113	
C124	same as C114	

TVA 142 PARTS LIST (cont)

Component Designation	H&F P/N	Description
C125	same as C113	
C126	same as C116	
C131	same as C111	
C132	same as C111	
C133	same as C113	
C134	same as C114	
C135	same as C113	
C136	same as C116	
C141	same as C111	
C142	same as C111	
C143	same as C113	
C144	same as C114	
C145	same as C113	
C146	same as C116	
C151	same as C111	
C152	same as C111	
C153	same as C113	
C154	same as C114	
C155	same as C113	
C156	same as C116	
C161	same as C111	
C162	same as C111	

TVA 142 PARTS LIST (cont)

Component Designation	H&F P/N	Description
C163	same as C113	
C164	same as C114	
C165	same as C113	
C166	same as C116	
C201	1529-7500	Capacitor, Polystyrene, Mallory SX-475, 75pF, 600 V
C202	1508-2200	Capacitor, Ceramic, Mallory GP-422, 22pF, 1 KV
C203	1529-1510	Capacitor, Polystyrene, Mallory SX-315 150 pF, 630 V
C204	same as C202	
C211	1529-3000	Capacitor, Polystyrene, Mallory SX-430, 30 pF, 600 V
C221	same as C211	
C231	same as C211	
C241	same as C211	
C251	same as C211	
C261	same as C211	
C301	same as C201	
C302	same as C202	
C303	same as C203	
C304	same as C204	
C311	same as C211	
C321	same as C211	

TVA 142 PARTS LIST (cont)

Component Designation	H&F P/N	Description
C331	same as C211	
C341	same as C211	
C351	same as C211	
C361	same as C211	
C401	same as C203	
C402	same as C202	
C403	same as C203	
C404	same as C204	
C511	1508-1031	Capacitor, Ceramic, Mallory TA-110, .01 uF, 100 V
C512	same as C511	
C521	same as C511	
C522	same as C511	
C531	same as C511	
C532	same as C511	
C541	same as C511	
C542	same as C511	
C551	same as C511	
C552	same as C511	
C561	same as C511	
C562	same as C511	
C601	same as C01	
C602	1508-2240	Capacitor, Ceramic, Mallory MAG-25022, .22 uF, 25 V

TVA 142 PARTS LIST (cont)

Component Designation	H&F P/N	Description
D501	0010-0005	Peak Flasher Display Assembly
D511	4800-4002	Diode, Silicon, 1N4002
D512	same as D511	
D521	same as D511	
D522	same as D511	
D531	same as D511	
D532	same as D511	
D541	same as D511	
D542	same as D511	
D551	same as D511	
D552	same as D511	
D561	same as D511	
D562	same as D511	
J01	2100-0106	Connector, 6-pin, Molex 09-60-1061
J111	2100-0104	Connector, 4-pin, Molex 09-60-1041
J121	same as J111	
J131	same as J111	
J141	same as J111	
J151	same as J111	
J161	same as J111	
J511	2100-0105	Connector, 5-pin, Molex 09-60-1051
J521	same as J511	

TVA 142 PARTS LIST (cont)

Component Designation	H&F P/N	Description
J531	same as J511	
J541	same as J511	
J551	same as J511	
J561	same as J511	
J601	2100-0103	Connector, 3-pin, Molex 09-60-1031
Q511	4849-2222	Transistor, 2N2222
Q512	same as Q511	
Q521	same as Q511	
Q522	same as Q511	
Q531	same as Q511	
Q532	same as Q511	
Q541	same as Q511	
Q542	same as Q511	
Q551	same as Q511	
Q552	same as Q511	
Q561	same as Q511	
Q562	same as Q511	
R111	4711-4472	Resistor, ¼ watt, 5%, 4.7 K
R112	same as R111	
R113	4711-4152	Resistor, ¼ watt, 5%, 1.5 K
R114	4711-4473	Resistor, ¼ watt, 5%, 47 K
R115	same as R111	

TVA 142 PARTS LIST (cont)

Component Designation	H&F P/N	Description
R116	4711-4164	Resistor, ¼ watt, 5%, 160 K
R117	same as R114	
R118	0010-0001	Control Assembly, 1 K
R121	same as R111	
R122	same as R112	
R123	same as R113	
R124	same as R114	
R125	same as R112	
R126	same as R116	
R127	same as R114	
R128	same as R118	
R131	same as R111	
R132	same as R111	
R133	same as R113	
R134	same as R114	
R135	same as R111	
R136	same as R116	
R137	same as R114	
R138	same as R118	
R141	same as R111	
R142	same as R111	
R143	same as R113	

TVA 142 PARTS LIST (cont)

Component Designation	H&F P/N	Description
R144	same as R114	
R145	same as R111	
R146	same as R116	
R147	same as R114	
R148	same as R118	
R151	same as R111	
R152	same as R111	
R153	same as R113	
R154	same as R114	
R155	same as R111	
R156	same as R116	
R157	same as R114	
R158	same as R118	
R161	same as R111	
R162	same as R111	
R163	same as R113	
R164	same as R114	
R165	same as R111	
R166	same as R116	
R167	same as R114	
R168	same as R118	
R201	4711-4393	Resistor, ½ watt, 5%, 39 K

TVA 142 PARTS LIST (cont)

Component Designation	H&F P/N	Description
R202	same as R111	
R203	4711-4103	Resistor, ¼ watt, 5%, 10 K
R204	same as R203	
R205	same as R111	
R206	4711-4301	Resistor, ¼ watt, 5%, 300 ohm
R207	same as R206	
R211	4711-4561	Resistor, ¼ watt, 5%, 560 ohm
R212	same as R111	
R221	same as R211	
R222	same as R111	
R231	same as R211	
R232	same as R111	
R241	same as R211	
R242	same as R111	
R251	same as R211	
R252	same as R111	
R261	same as R211	
R262	same as R111	
R301	same as R201	
R302	same as R111	
R303	same as R203	
R304	same as R203	

TVA 142 PARTS LIST (cont)

Component Designation	H&F P/N	Description
R305	same as R203	
R306	same as R206	
R307	same as R206	
R311	same as R211	
R312	same as R111	
R321	same as R211	
R322	same as R111	
R331	same as R211	
R332	same as R111	
R341	same as R211	
R342	same as R111	
R351	same as R211	
R352	same as R111	
R361	same as R211	
R362	same as R111	
R401	same as R203	
R402	same as R111	
R403	same as R203	
R404	same as R203	
R405	same as R111	
R406	same as R206	
R407	same as R206	

TVA 142 PARTS LIST (cont)

Component Designation	H&F P/N	Description
R511	same as R203	
R512	same as R203	
R513	4711-4222	Resistor, ¼ watt, 5%, 2.2 K
R514	same as R513	
R521	same as R206	
R522	same as R206	
R523	same as R513	
R524	same as R513	
R531	same as R206	
R532	same as R206	
R533	same as R513	
R534	same as R513	
R541	same as R206	
R542	same as R206	
R543	same as R513	
R544	same as R513	
R551	same as R203	
R552	same as R203	
R553	same as R513	
R554	same as R513	
R561	same as R203	
R562	same as R203	

TVA 142 PARTS LIST (cont)

Component Designation	H&F P/N	Description
R563	same as R513	
R564	same as R513	
R601	4711-4100	Resistor, ¼ watt, 5%, 10 ohm
R602	4766-2502	Trim Pot, CTS 201R50-2B, 5K
R603	4711-4332	Resistor, ¼ watt, 5%, 3.3 K
R604	same as R203	
R605	same as R203	
R606	4711-4824	Resistor, ¼ watt, 5%, 820 K
R607	same as R206	
R608	same as R203	
R609	same as R203	
R610	same as R606	
R611	same as R206	
S111	5134-0003	Dip.Switch, AMP 435470-5, DPDT
S112	5134-0002	Dip Switch, AMP 435665-2, SPST
S121	same as S111	
S122	same as S112	
S131	same as S111	
S132	same as S112	
S141	same as S111	
S142	same as S112	
S151	same as S111	
S152	same as S112	

TVA 142 PARTS LIST (cont)

Component Designation	H&F P/N	Description
S161	same as S111	
S162	same as S112	
S511	0010-0002	H&F Switch Assembly
S521	same as S511	
S531	same as S511	
S541	same as S511	
S551	same as S511	
S561	same as S511	
T111	5605-0003	Transformer, Sescom custom, 150/15K:15K
T121	same as T111	
T131	same as T111	
T141	same as T111	
T151	same as T111	
T161	same as T111	
TB1	2100-0035	Terminal Strip, Magnum, 2061-15-06-AB
TB2	same as TB1	
TB3	2100-0036	Terminal Strip, Magnum, 2051-15-06-AB
TB4	same as TB3	
U111	3130-5534	Operational Amplifier, NE5534
U121	same as U111	
U131	same as U111	
U141	same as U111	

TVA 142 PARTS LIST (cont)

Component Designation	H&F P/N	Description
U151	same as U111	
U161	same as U111	
U201	same as U111	
U202	same as U111	
U212	3717-0001	Optical Isolator, Vactec VTL 5C2
U222	same as U212	
U232	same as U212	
U242	same as U212	
U252	same as U212	
U262	same as U212	
U301	same as U111	
U302	same as U111	
U312	same as U212	
U322	same as U212	
U332	same as U212	
U342	same as U212	
U352	same as U212	
U362	same as U212	
U401	same as U111	
U402	same as U111	
U501	3130-7914	Hex Schmidt Trigger, 74C914
U502	3130-7907	Hex Buffer, 74C907

TVA 142 PARTS LIST (cont)

Component Designation	H&F P/N	Description
U503	same as U502	
U504	same as U501	
U505	same as U502	
U506	same as U502	
U601	3130-0555	Timer, NE555V
U602	same as U601	

TVA 142 PARTS LIST
(Non-designated Parts)

H&F P/N	Description
1400-0110	Chassis Top
1400-0503	Rack Panel
1400-0504	Chassis Front
1400-0505	Chassis Rear
1400-0509	Chassis Box
2100-0005	Dip Socket, 8-pin
2100-0006	Dip Socket, 14-pin
2100-0019	Fuse holder, Buss HKP
2100-0158	Contact, Molex 08-50-0108
2100-0226	Connector, Molex 09-50-3061, 6-pin locking
2180-2214	Crimp connector, Waldom CE02214
2410-0001	Knob, Rogan RB6735K7M ¼ Blk
2803-0006	Spacer, Mallory TCBS 6N, 3/8"
2807-8349	Spacer, H.H. Smith 8349, 1-½"
3130-7812	Regulator, 7812, +12 V
3130-7818	Regulator, 7818, +18 V
3130-7918	Regulator, 7918, -18 V
5104-0005	Fuse, Buss AGC ½, ½ amp
5633-8613	Transformer, Stancor P8613, 36 V
6028-7239	Line cord, Belden 17239B
6036-0939	Strain Relief, H.H. Smith 939

0010-0001 CONTROL ASSEMBLY, 1 K

H&F P/N	Description
2100-0124	Connector, Molex 09-50-7014, 4-pin
2100-0158	Pin, Molex 08-50-0108
4757-0102	Pot, Bournes 86AZAB28B10R51, 1K

0010-0002 SWITCH ASSEMBLY

H&F P/N	Description
2100-0125	Connector, Molex 09-50-7051, 5-pin
2100-0158	Pin, Molex 08-50-0108
3714-5053	LED, Monsanto MV5053, Red
3714-5153	LED, Monsanto MV5153, Orange
5142-0001	Switch, Capitol HLB

0010-0005 PEAK FLASHER DISPLAY ASSEMBLY

H&F P/N	Description
2100-0123	Connector, Molex 09-50-7031, 3-pin polarized
2100-0158	Contacts, Molex 08-50-0108
3714-5053	LED, Monsanto MV5053, Red
3714-5153	LED, Monsanto MV5153, Orange

D17 protect the regulators from having a higher output voltage than input voltage (possible if input capacitors accidentally shorted). C13 and C15 insure stable operation of the regulators, and improve transient regulation. D16 and D18 protect the regulators from opposite polarity signals that may come from the load. Such may occur if the positive and negative outputs are shorted together.

The remaining supply circuitry operates in the same manner. Note that if only one transformer winding is used, MOV21 and MOV22 may be deleted.